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BOOK OF ABSTRACT

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#542 - Phosphorene, a new two dimensional platform for advanced materials

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Two dimensional materials are still an unexplored territory. Graphene is one of the principal platform on which material scientists have only recently started to play.[1] On the other side, it was estimated that a few hundreds of layered materials could be exfoliated to give a 2D crystal, allowing a large growing opportunity of research.
Only small amounts of single and few layers sheets of Phosphorene, the all-P counterpart of graphene, have been prepared by exfoliation of black phosphorus, the most stable and least reactive of the allotropic forms of phosphorus, either by micromechanical cleavage (Scotch tape method) or liquid exfoliation.[2]
A phosphorene sheet has the same honeycomb hexagonal network of graphene but it is corrugated having the P atoms an sp^3 hybridization. Phosphorene is a natural semiconductor, and the band gap can be controlled by changing the number of stacked layers. This makes the materials very promising for a wide variety of electronic applications.
On the other hand, almost nothing is known about the reactivity and the physico-chemical properties of this new fascinating material, and only sparse theoretical [3] and experimental [4] studies have been reported so far.
In this communication, we present our results on the synthesis of phosphorene. We will describe its adsorption properties towards different gaseous molecules, such as CO_2, CO, O_2 and H_2 and its functionalization using metallic fragments or metal nanoparticles.
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#543 - Multilayered Ge quantum dots embedded in SiO2: structural and optical analysis

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In the past years Ge quantum dots (QDs) gained a renewed scientific interest over Si QDs due to the lower synthesis temperature, higher absorption coefficient and larger exciton Bohr radius [1]. The optical behavior and the band-gap tuning of Ge QDs do not simply depend on the size, as the quantum confinement effect (QCE) predicts, but also on QD-QD distance and ordering. In this work, Ge quantum dots (2-10 nm in diameter) in SiO_2 grown by plasma-enhanced chemical vapor deposition, will be reviewed evidencing whether and to which extent the quantum confinement affects the light-matter interaction. In order to investigate the features of QCE by controlling the QD diameter, multilayers of Ge QDs embedded in SiO_2, separated by an SiO_2 barrier layers (20 nm thick) were synthesized by plasma enhanced chemical vapor deposition and annealing at 800°C. The multilayer approach allows a narrower size distribution in comparison to single layer of QDs (where no SiO_2 barrier layers are involved). We present a detailed study on structural and optical properties of multilayer samples compared with single layer ones. In multilayer samples TEM analysis shows a narrow size distribution of very small Ge QDs (~2 nm). Using UV-Vis-NIR spectrometry and Tauc analysis of the absorption spectra, the optical bandgap and the absorption efficiency of Ge QDs were extracted. In comparison to single layer samples, with similar optical band gap values (~1.8÷2 eV), multilayered Ge QDs show a light absorption efficiency ten times higher. This effect evidence that a significant QD-QD interactions exists which greatly affect the light absorption efficiency.

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#544 - Phosphorus Diffusion and Incorporation in Silicon Nanoclusters Embedded in Silicon Oxide

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